NEWS

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NASA ANTI-POLLUTION EXPERIMENT

Aerospace know-how is being brought to bear against a major source of air pollution in the United States -- automobile exhaust.

Each car on the road today exhausts between one-quarter to one-half ton of carbon monoxide and hydrocarbons a year. These pollutants come from incomplete fuel combustion in a car's engine. The National Aeronautics and Space Administration's Lewis Research Center, Cleveland, is investigating a method of completing combustion in a thermal reactor.

A thermal reactor would replace the standard exhaust manifold in a car and serve as an afterburner. Tests by industry already have shown such a reactor could reduce carbon monoxide and the hydrocarbons to within predicted 1980 Federal requirements. But difficult materials and design problems first must be solved in order to develop a reactor that has a long life and is inexpensive.

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To do its job, a reactor must withstand normal operating temperatures between 1,400 and 1,900 degrees F. and occasionally handle temperatures over 2,000 degrees in the case of a spark-plug failure, when unburned fuel-air mixture from the "missing" cylinder flows into the reactor. It also must be able to take the thermal shock from a cold engine start, and the severe mechanical vibrations of rugged driving conditions.

The Lewis Center was asked by the National Air Pollution Control Administration (NAPCA) of the Department of Health, Education and Welfare to study these problems and develop the technology to solve them.

At Lewis, research is aimed at a better understanding of combustion phenomena and reactor limits. Engineers are using a V-8 engine equipped with experimental thermal reactors. The engine is connected to a dynamometer which absorbs the power generated by the motor. Over a range of speeds and loads, instruments measure the temperature of the exhaust and content of the pollutants.

These and other studies have shown a minimum temperature of 1,400 degrees in the reactor is required to clean up the exhaust products. As air is introduced into the reactor, it combines with carbon monoxide and with hydrocarbons to produce carbon dioxide and water vapor. For the reactor to operate properly, the gasoline-to-air ratio in the car's engine must be fuel-rich.

Although some fuel economy may thus have to be sacrificed, a side benefit is that less nitrogen oxides will be produced in the combustion process. Nitrogen oxides, also pollutants, are not burned up in a thermal reactor.

Complementing this research, studies under contract to Lewis and funded by NAPCA will survey candidate materials and develop better reactor designs.

Two of the contracts focus on metallic reactors. Teledyne Continental Motors of Muskegon, Mich., has a $277,000 contract to evaluate existing metal alloys and coatings. The company will investigate iron-chromium-aluminum alloys that are inexpensive and have good oxidation resistance, and also coated high temperature materials. Battelle Memorial Institute of Pacific Northwest Laboratories has a $97,000 Lewis contract to develop improved iron-based alloys. Part of this study will be to evaluate special processing techniques for a high strength, oxidation-resistant alloy.

A contract to study non-metallic reactors will be awarded later. These reactors would have a core made of a material such as a ceramic. Ceramics can withstand extremely high temperatures and have no oxidation problems. But they also are very brittle. Consequently, the primary objective of the study will be to marry non-metallic core to a reactor design that will enable it to withstand mechanical shock and endure 1,200 hours of engine running time.

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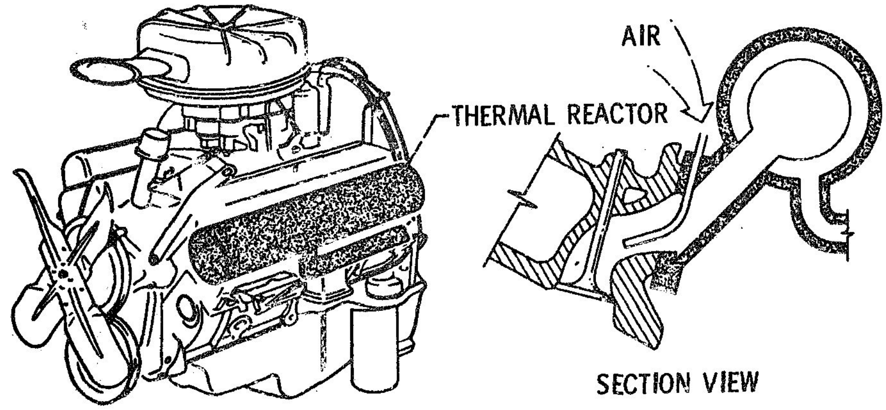
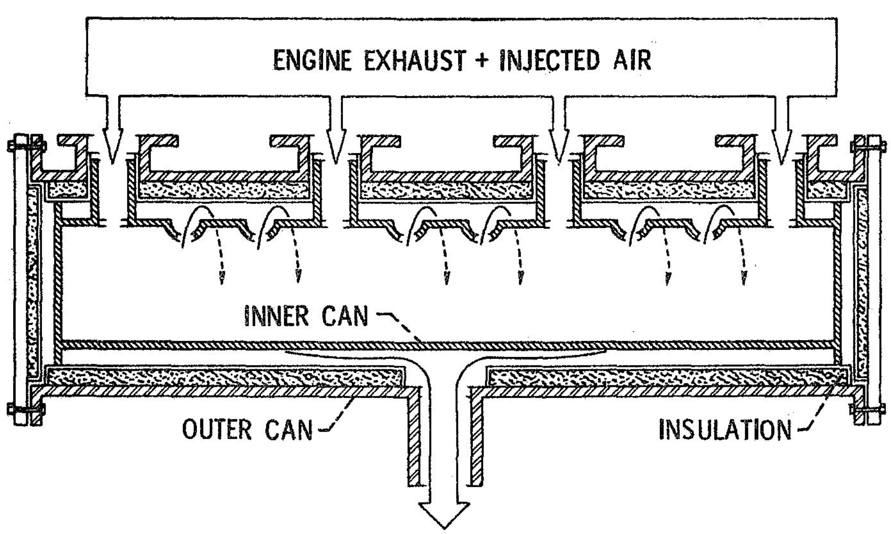


AIR
THERMAL REACTOR
SECTION VIEW



ENGINE EXHAUST + INJECTED AIR
INNER CAN
OUTER CAN
INSULATION
TO EXHAUST SYSTEM